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Patent Abstracts of Japan

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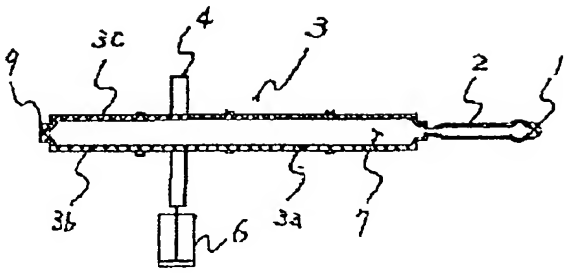
TITLE : BLOW MOLDING AND ITS FORMING METHOD



ABSTRACT : PROBLEM TO BE SOLVED: To reduce a necessary resin amount and to upgrade transferability by using a mold having a shut-off valve installed at a position froth a flow inlet side corresponding to a volume obtained by subtracting a predicted volume of a hollow part from an overall volume of a product.

SOLUTION: A switching shut-off valve 4 is installed at a position of a value obtained by subtracting a predicted volume of a hollow part from an overall volume of a product, and melted resin 3 is charged in a cavity 3a via a sprue 1 and a runner 2 in the state that the valve 4 is closed. In this state, since an internal pressure is applied to the resin 3 in the cavity 3a, it is effectively transferred to a part of a fine shape. Thereafter, high pressure gas 7 is introduced from the sprue 1, and the valve 4 is opened by a cylinder 6 simultaneously or by slightly delaying. As a result, the resin 3 of the cavity 3a is urged out forward from the valve 4 to form a hollow part 7. Thus, a desired product shape 3c is obtained by a dwelling effect due to the pressure of the gas 7.

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(21) Application No. 9-116323
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(71) Applicant: Musashi Kako Inc.
(54) [TITLE OF THE INVENTION]
Hollow Molded Part and Manufacturing Method of the Same
[SCOPE OF CLAIMS FOR PATENT]
[CLAIM 1] A hollow molded part produced by a mold where an on-off shutoff valve is located in position a certain distance ahead of an entrance of the fluidized material to partition a mold cavity so that a proximal cavity segment keeps a volume obtained by subtracting an estimated volume of a center hollow portion of the molded product from a total net volume of an outer shell of the molded product.
[CLAIM 2] A hollow molded part obtained by a molding method where, during injection molding, a mold cavity is initially filled with resin while a shutoff valve keeps closed, and then, gas is injected in the cavity almost simultaneous with opening the shutoff valve to spread the resin still in molten phase to a distal end of the cavity beyond the shutoff valve so as to obtain the molded part of the desired shape.
[CLAIM 3] An injection molding method and a mold used for blow injection molding to fabricate the hollow molded part as defined in claim 1.
[CLAIM 4] An injection molding method and a mold used for blow injection molding to fabricate the hollow molded part as defined in claim 2.
[DESCRIPTION OF THE INVENTION]
[0001]
[FIELD OF THE INVENTION]
The present invention relates to a hollow molded part of thermoplastic resin and a manufacturing method of the same.
[PRIOR ART]
[0002]
Typically in the art, blow injection molding is broadly classified in the short shot method and the full shot method. For instance, the short shot method includes procedures of injecting molten resin to fill a mold cavity with the resin of an amount less than the full volume of the cavity, and then sending compressed gas in the cavity to spread the resin around the cavity in

order to transfer the desired mold shape. In contrast, the full shot method is a molding method where after resin as much as the full volume of the cavity is injected in the cavity, compressed gas is supplied to thrust part of the resin out of the cavity to the external space (i.e., portions named 'tub' or 'waste cavity') so as to obtain a mold part of the desired shape with its center portion left hollow. Thus, both the shot methods are selectively exploited, allowing for a quality level of the mold product and the manufacturing economics.

[0003]

[DISADVANTAGED OF THE PRIOR ART]

These shot methods, however, have respectively been found to have some disadvantages as mentioned below.

(1) In the short shot method where, in order to obtain a molded product of the desired shape, the mold cavity is first filled with molten resin of an amount less than the full volume of the cavity and then supplied with compressed gas to spread the molten resin around the cavity, there is an advantage that the molded product can be obtained with a reduced amount of resin, but there also arise various disadvantages that the distal end of the fluidized material is left thickened, that very fine contours of the mold are hard to transfer, that mass production leads to molded pieces which are not uniform as a result of uneven transfer of the cavity shape, and so forth.

(2) In the full shot method where, in order to obtain a molded product of the desired shape, the mold cavity is first filled with molten resin of an amount as much as the full volume of the cavity and then supplied with compressed gas to thrust part of the molten resin out of the cavity to the 'tub' or the 'waste cavity' to leave the center portion hollow, the above disadvantages of the short shot method can be compensated, but there still is a disadvantage that the portion shaped by the waste cavity (30% of the total weight of the molded product) should be discarded or reused.

As has been described, either of the methods is considerably disadvantageous, and some of their advantages exist by virtue of sacrifices of other advantages. Accordingly, it is an object of the present invention to provide a mold for blow injection molding and a method of the same.

[0004]

[SOLUTIONS]

An on-off shutoff valve located in a mold is in position a certain distance ahead of a fluidized material entrance to partition a mold cavity so that a

proximal cavity segment keeps a volume obtained by subtracting an estimated volume of a center hollow portion of the molded product from its total volume, and after the cavity segment defined by the shutoff valve is filled with molten resin, gas is injected to spread the resin around the cavity to obtain the molded product of the desired shape.

[0005]

[IMPROVED FEATURES]

An on-off shutoff valve is located in position to partition about 70% of the product volume off the mold cavity to define a cavity segment directly leading from an entrance of the fluidized material (precisely, the volume of the cavity segment is obtained by subtracting an estimated volume of a center hollow portion of the product from its total volume), and while the shutoff valve keeps closed, the cavity segment is filled with molten resin. Thus, pressure distributed over the high temperature molten resin in the initial stage of the filling is applied even to corners of minute part of the mold, and this enhances transferability of the mold contours with reduced influence of jetting, which useful to stabilize the grade of the molded product. After that, opening the shutoff valve and injecting gas permit the resin to spread around the cavity to give the desired shape to the product, and in this manner, hollow molded pieces of a stable high grade can be produced, saving the material resin due to the minimal use of it.

[0006]

[EMBODIMENTS]

Embodiments of the present invention will be described in conjunction with the accompanying drawings. Fig. 1 depicts an exemplary hollow molded part according to the present invention. Figs. 2 to 4 illustrate configurations according to the present invention; Fig. 2 is a top plan view of a mold cavity with a shutoff valve 4 being closed, showing the filling of resin being completed, Fig. 3 is a side view of Fig. 2, and Fig. 4 is a sectional view taken along the line A-A in Fig. 2. A cylinder 6 connects a movable shutoff valve 4a with a fixed shutoff valve 4b to open and close a fluid path 5. While the shutoff valve 4 (4a and 4b) is closed, molten resin is transferred through a sprue 1 into a runner 2 to fill a cavity 3a with the resin. This results in the same effect as brought about by the aforementioned full shot method, and under the circumstances, the internal pressure is applied to the molten resin 3 in the cavity 3a (although an incomplete filling of the cavity by the short

shot method does not cause so much internal pressure to be applied to the molten resin), which enables the molten resin to spread out into very narrow gauge ribs 8 to ensure a fine transfer.

[0007]

After that, as illustrated in Fig. 5, compressed gas 7 injected through the sprue 1 is directed at the resin (alternatively, the compressed gas may be injected through the runner or from the cavity), and simultaneous with this, or slightly after, the cylinder 6 or other means is used to open the shutoff valve 4. With the shutoff valve 4 being opened, the compressed gas 7 thrusts part of the resin 3 out of the cavity 3a ahead of the shutoff valve 4 to leave center part 7 hollow, and the dwell pressure derived from the compressed gas 7 brings about a molded part 3c of the desired shape. Eventually, after a certain period to keep the dwell condition, the molded part 3c is taken. During this procedure, as the shutoff valve 4 is left open, the molded part can be pushed forward, and after the molded part is removed from the mold, the shutoff valve 4 is closed no later than the succeeding mold filling is carried out.

[0008]

Also, in an embodiment shown in Fig. 6, a considerably small waste cavity 10 is defined in a tip of the fluid path. The waste cavity 10 permits the gas 7 to pass beyond the extreme distal end of the mold to avoid leaving a thickened portion 9 at the distal end of the fluidized material.

[0009]

Figs. 7 to 9 illustrate a series of process steps from the filling with resin till the end of the post-treatment under the dwell condition. Especially, Fig. 7 depicts the filling with resin, Fig. 8 shows the beginning of gas injection, and Fig. 9 illustrates the completed gas injection.

[0010]

Finally, a well-known blow molding according to a general method other than the present invention will now be described in comparison with the present invention. Figs. 10 to 13 illustrate the short shot method; Fig. 10 depicts the filling with resin, Fig. 11 shows the beginning of gas injection, and Fig. 12 illustrate completion of gas injection. The cavity, while being filled with resin as shown in Fig. 10, still has some part left unfilled and gets rid of so much internal pressure, and this resultantly leaves some part 11 of the very narrow gauge ribs 8 in short supply with the resin. Since the resin has

its outer surface cured first, the subsequent gas injection could not do any longer with the short supply at that part 11. Figs. 14 and 15 illustrate the full shot method; especially, Fig. 14 depicts the filling with resin while Fig. 15 shows completion of gas injection. In these situations, a shutoff valve is, although not shown, often located at an entrance of the waste cavity. In contrast with the shot method and the mold configuration described so far in relation with the prior art embodiment, the shutoff valve 4 used in terms of the shot method and the mold configuration according to the present invention is located in the midst of the mold cavity.

[0011]

[EFFECTS OF THE INVENTION]

Configured as mentioned above, the present invention attains effects as listed below.

(1) Since the shutoff valve is located in the midst of the mold cavity, an amount of resin may be reduced to as much as sufficient to fill part of the mold cavity sectioned by the shutoff valve.

(2) Since gas is injected after completely filling the cavity with resin, a certain degree of the internal pressure within the cavity permit improved transferability of very fine contours of the mold.

(3) Since resin almost as much as used in the short shot method is sufficient to fully fill the sectioned mold cavity as in the full shot method, the precision-enhanced and cost-effective molding can be attained.

As has been described, the present invention implements hybrid molding of the full shot and short shot methods in which an amount of resin less than the volume of a mold cavity space (complete cavity volume) is sufficient as in the ordinary short shot method although benefits of precise transferability and high molding stability are still ensured as in the full shot method, so that molded products of stable grade can be efficiently obtained at a reduced cost.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIGURE 1] A diagram showing a hollow molded part of the present invention.

[FIGURE 2] A top plan view of a mold cavity.

[FIGURE 3] A side view of the cavity.

[FIGURE 4] A sectional view along the line A-A of Fig. 2.

[FIGURE 5] A top plan view of the cavity upon completion of gas injection.

[FIGURE 6] A plan view illustrating an embodiment where a considerably

small waste cavity is provided at a distal end of a fluid path.

[FIGURE 7] A top plan view of the invention upon the filling with resin.

[FIGURE 8] A top plan view of the invention upon gas injection.

[FIGURE 9] A top plan view of the invention upon completion of gas injection.

[FIGURE 10] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 11] A top plan view of the well-known example other than the present invention upon gas injection in the shot method.

[FIGURE 12] A top plan view of the well-known example other than the present invention upon completion of gas injection in the short shot method.

[FIGURE 13] An enlarged view showing one of very narrow gauge ribs in the course of the prior art molding in the short shot method.

[FIGURE 14] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 15] A top plan view of the well-known example other than the present invention upon completion of gas injection in the full shot method.

[DESCRIPTIONS OF REFERENCE ALPHANUMERIC SYMBOLS]

1	Sprue
2	Runner
3	Molten Resin
3a	Cavity
3b	Cavity
3c	Molded Part
4	Shutoff valve
4a	Movable Shutoff valve
4b	Fixed Shutoff valve
5	Fluid Path
6	Cylinder
7	Compressed Gas
8	Very Narrow Gauge Ribs
9	Thickened Portion
10	Waste Cavity
11	Part in Short Supply

(57) [ABSTRACT]

[OBJECT OF THE INVENTION]

An on-off shutoff valve is located in position to partition about 70% of the product volume off the mold cavity to define a cavity segment directly leading from an entrance of the fluidized material (precisely, the volume of the cavity segment is obtained by subtracting an estimated volume of a center hollow portion of the product from its total volume), and while the shutoff valve keeps closed, the cavity segment is filled with molten resin. Thus, pressure distributed over the high temperature molten resin in the initial stage of the filling is applied even to corners of minute part of the mold, and this enhances transferability of the mold contours with reduced influence of jetting, which useful to stabilize the grade of the molded product. After that, opening the shutoff valve and injecting gas permit the resin to spread around the cavity to give the desired shape to the product, and in this manner, hollow molded pieces of a stable high grade can be produced, saving the material resin due to the minimal use of it.

[SOLUTION]

An on-off shutoff valve located in a mold is in position a certain distance ahead of a fluidized material entrance to partition a mold cavity so that a proximal cavity segment keeps a volume obtained by subtracting an estimated volume of the center hollow portion from a total volume of the molded product, and after the cavity segment defined by the shutoff valve is filled with molten resin, gas is injected to spread the resin around the cavity to obtain the molded product of the desired shape.